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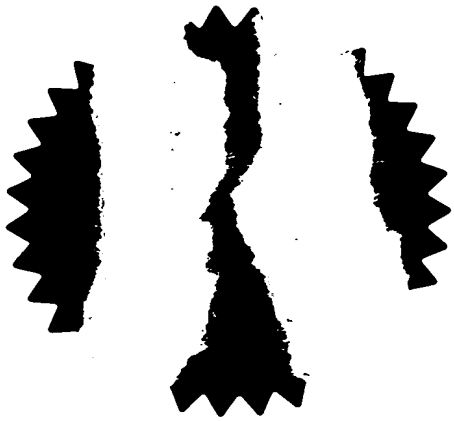

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Dated 1 September 2003

Patents Form 1/77

Patents Act 1977
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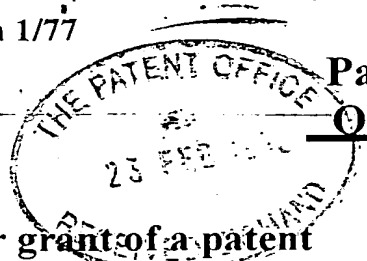

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
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1.	Your reference	TAB/50088/000
2.	Patent application number *(The Patent Office will fill in this part)*	23 FEB 1998 **9803780.7**
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)*	**BESPAK PLC** **BERGEN WAY** **NORTH LYNN INDUSTRIAL ESTATE** **KING'S LYNN** **NORFOLK PE30 2JJ** **UNITED KINGDOM**
	Patents ADP number *(if you know it)*	13723480001
	If the applicant is a corporate body, give the country/state of its incorporation	**UNITED KINGDOM**
4.	Title of the invention	**IMPROVEMENTS IN OR RELATING TO METERING VALVES FOR PRESSURISED DISPENSING CONTAINERS**
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	**BOULT WADE TENNANT** **27 FURNIVAL STREET** **LONDON** **EC4A 1PQ**
	Patents ADP number *(if you know it)*	**42001**

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number (if you know it)	Date of filing *(day/month/year)*

7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing *(day / month / year)*

8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	**YES**

Issued 21-1-99.

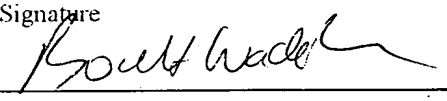
9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	5
Claim(s)	2
Abstract	
Drawing(s)	1

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(Please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature  Date 23 February 1998

12. Name and daytime telephone number of person to contact in the United Kingdom

MRS. T.A. BUCKS
0171 404 5921

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Notes

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IMPROVEMENTS IN OR RELATING TO METERING VALVES FOR PRESSURISED DISPENSING CONTAINERS

This invention relates to metering valves for pressurised dispensing containers.

Conventional metering valves for use with pressurised dispensing containers comprise a valve stem coaxially slidable within a valve member defining an annular metering chamber, and outer and inner annular seals operative between the respective outer and inner ends of the valve stem and the valve member to seal the metering chamber therebetween. The valve stem is hollow whereby in a non-dispensing position of the valve stem, the metering chamber is connected to the container and charged with product therefrom. The valve stem is movable against the action of a spring to a dispensing position wherein the metering chamber is isolated from the container and vented to atmosphere for the discharge of product.

A problem with this type of metering valve, especially when used with a liquid propellant having a particulate product suspended therein, is the deposition of the solid product on the internal surfaces of the metering chamber and other components after a number of operation cycles and/or storage. This can lead to reduced efficiency of operation of the valve since deposition of the product reduces the amount of active drug available to be dispensed (due to the active drug remaining on the surfaces of the chamber and valve stem). Prior art devices rely on the container and attached valve being shaken in an attempt to dislodge the deposited particles as a result of the movement of the liquid propellant and product mixture. However, whilst this remedy is effective within the body of the container itself, it is not effective for particles deposited on the inner surfaces of the metering chamber. As the size of the

chamber is significantly smaller, the restricted flow of fluid in the metering chamber (caused by the tortuosity of the flow path through the chamber) means that the fluid in the metering chamber does not move with enough energy to adequately remove the deposited particles.

One solution is proposed in our pending application GB 9721684.0 in which a liner of a material such as fluoropolymer, ceramic or glass is included to line a portion of the wall of the metering chamber. Although this solves the problem of deposition, it does require the re-design or modification of moldings and mould tools for producing the valve members to allow for the insertion of the liner.

It is an object of the present invention to provide a metering valve in which the deposition of the product and active drug component on the walls on the metering chamber is minimised without the need of an additional component part.

According to the invention there is provided a metering valve for use with a pressurised dispensing container, the valve comprising a valve stem co-axially slidable within a valve member, said valve member and valve stem defining an annular metering chamber, outer and inner annular seals operative between the respective outer and inner ends of the valve member and the valve stem to seal the annular metering chamber therebetween, wherein at least a portion of the metering valve is treated to have a layer of a plasma polymer bonded to at least a portion of an internal surface of the metering chamber.

A particular embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawing which is a cross sectional view of a metering valve according to the present invention.

The metering valve 10 includes a valve stem 11 which protrudes from and is axially slidable within a valve member 12, the valve member 12 and valve stem 11 defining therebetween an annular metering chamber 13. The valve member 12 is located within a valve body 14 which is positioned in a pressurised container (not shown) containing a product to be dispensed. The metering valve 10 is held in position with respect to the container by means of a ferrule 15 crimped to the top of the container and sealing being provided between the valve body 14 and container by an annular gasket 16.

An outer seal 17 and an inner seal 18 of an elastomeric material extend radially between the valve stem 11 and the valve member 12. The outer seal 17 is radially compressed between the valve member 12 and valve stem 11 so as to provide positive sealing contact, the compression being achieved by using a seal which provides an interference fit on the valve stem 11 and/or by the crimping of the ferrule 15 onto the pressurised container during assembly.

The valve stem 11 has an end 19 which protrudes from the valve member 12 and ferrule 15 which is a hollow tube and which is closed off by flange 20 which is located within the metering chamber 13. The hollow end 19 of valve stem 11 includes a discharge port 21 extending radially through the side wall of the valve stem 11. The valve stem 11 further has an intermediate section 22, which is also hollow and defining a central passage and which has a pair of spaced radial ports 23, 24 which are interconnected through a central cavity.

A spring 25 extends between a second flange 26, separating the intermediate section 22 of the valve stem 11 and an inner end 27 of the valve stem 11, and an end of the valve body 14 to bias the valve stem 11 in a non-dispensing position in which the first flange

20 is held in sealing contact with the outer seal 17. The second flange 26 is located outside the valve member 12, but within the valve body 14.

The metering chamber 13 is sealed from the atmosphere by the outer seal 17, and from the pressurised container to which the valve 10 is attached by the inner seal 18. In the illustration of the valve 10 shown in Fig. 1 radial ports 23, 24 together with the central cavity in the intermediate section 22 of the valve member 11 connect the metering chamber 13 with the container so that in this non-dispensing condition the metering member 13 will be charged with product to be dispensed.

Upon depression of the valve stem 11 relative to the valve member 12 so that it moves inwardly into the container, the radial port 24 is closed off as it passes through the inner seal 18, thereby isolating the metering chamber 13 from the contents of the pressurised container. Upon further movement of the valve stem 11 in the same direction to a dispensing position the discharge port 21 passes through the outer seal 17 into communication with the metering chamber 13. In this dispensing position the product in the metering chamber 13 is free to be discharged to the atmosphere via the discharge port 21 and the cavity in the hollow end 19 of the valve stem 11.

When the valve stem 11 is released, the biasing of the return spring 25 causes the valve stem 11 to return to its original position. As a result the metering chamber 13 becomes recharged in readiness for further dispensing operations.

Conventional valve members and valve stems are formed as single mouldings from materials such as acetal, polyester or nylon which are prone to the deposition problems described above. In the present invention valve members and valve stems made by conventional tooling and moulds from these traditional

materials are subjected to a cold plasma polymerisation treatment which creates a very thin layer of a plasma polymer, such as plasma polymerised tetrafluorethylene, on the surface of the valve members and valve stems which significantly reduces the deposition of active drugs on the internal surfaces of the metering chamber defined by the valve member and valve stem.

The process is known as "cold plasma" treatment as the temperature within the body of the plasma is ambient. Thus thermoplastic materials such as PBT, nylon and acetal can be treated without fear of thermal damage. The treatment is a vacuum procedure in which the components are placed inside a chamber which is evacuated to less than 0.005 Torr. A monomer is introduced to the chamber at a controlled rate and the 13.56 MHz r.f. signal is applied to an external antenna. The plasma is ignited within the chamber and maintained for a given time at the preselected power setting. At the end of the chamber the plasma is extinguished, the chamber flushed and the products retrieved. As a result a thin layer (for example 0.005 to 0.5μ) of, say, plasma polymerised tfe is intimately bonded to the surface of the component.

Alternatively, just the valve member alone may be treated. However, additional benefits can be achieved in treating some or all of the other plastic and rubber parts of the metering valve including the valve body 14 and the seals 16, 17 and 18.

CLAIMS:

1. A metering valve for use with a pressurised dispensing container, the valve comprising a valve stem co-axially slidable within a valve member, said valve member and valve stem defining an annular metering chamber, outer and inner annular seals operative between the respective outer and inner ends of the valve member and the valve stem to seal the annular metering chamber therebetween, wherein at least a portion of the metering valve is treated to have a layer of a plasma polymer bonded to at least a portion of an internal surface of the metering chamber.

2. A metering valve as claimed in claim 1 in which the plasma polymer is plasma polymerised tetrafluoroethylene.

3. A metering valve as claimed in any one of the preceding claims in which the treated portion of the metering valve is made from a plastic polymer or synthetic rubber.

4. A metering valve as claimed in any one of the preceding claims in which at least a portion of the surface of the valve member has a layer of plasma polymer bonded thereto.

5. A metering valve as claimed in any one of the preceding claims in which at least a portion of the surface of the valve stem has a layer of plasma polymer bonded thereto.

6. A metering valve as claimed in any one of the preceding claims in which at least a portion of the

surface of the seals have a layer of plasma polymer bonded thereto.

7. A metering valve as claimed in any one of the preceding claims in which the valve further comprises a valve body in which the valve member is located, the valve body having a layer of plasma polymer bonded to at least a portion of its surface.

8. A metering valve as claimed in any one of the preceding claims further comprising a gasket extending between the sealing surfaces of the metering valve and a pressurised dispensing container, said gasket having a layer of plasma polymer bonded to at least a portion of the surface thereof.

9. A metering valve substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

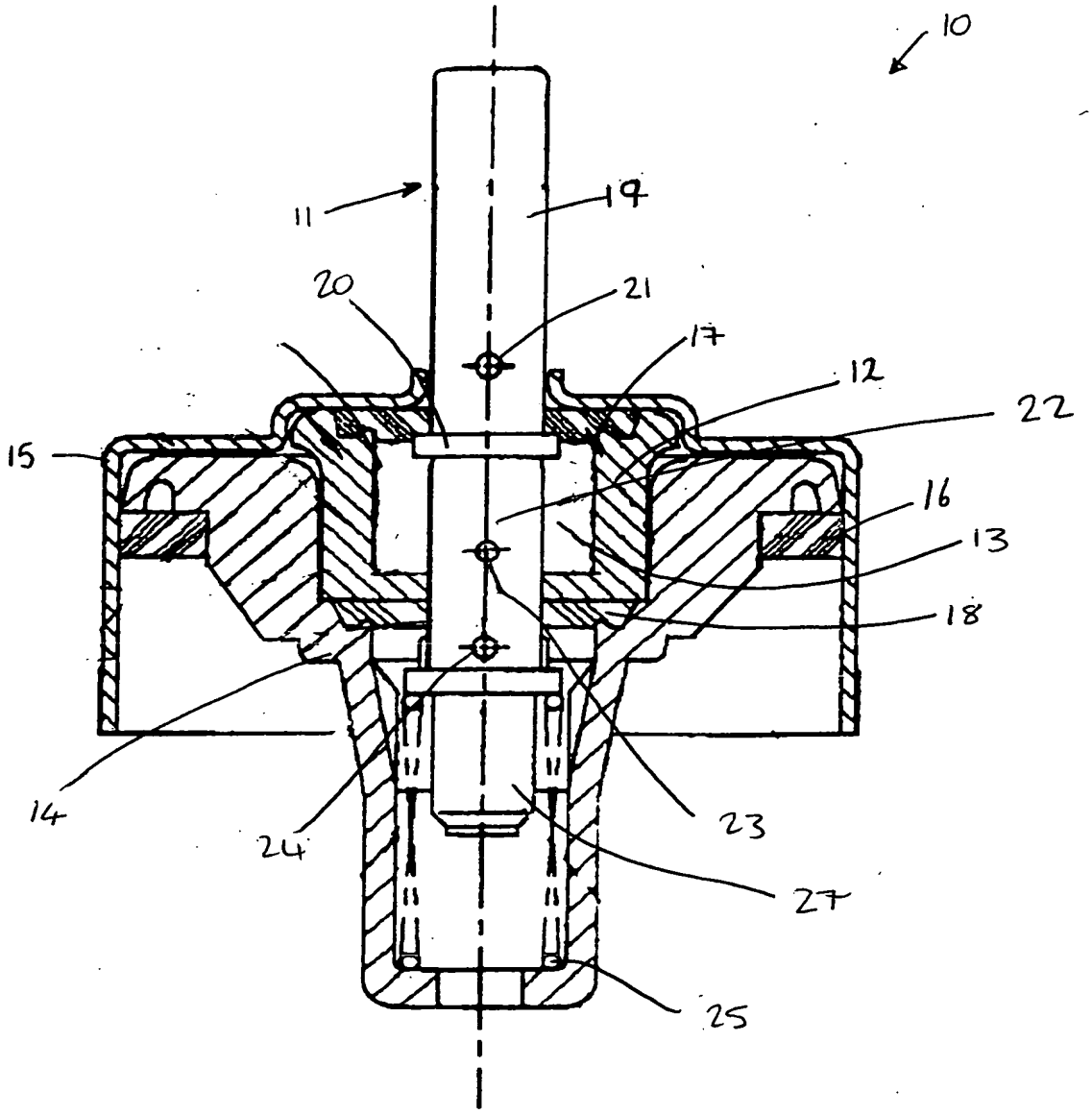

Fig 1